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REMARKS

In the office action, the examiner rejected Claims 9 and 10 under 35 U.S.C. 102(b) as being anticipated by Nishimura et al. (Japanese Laid-Open Patent Publication No. 55-42760). Further, the examiner rejected Claims 3-8 under 35 U.S.C. 103(a) as being unpatentable over the cited Nishimura et al. reference. Accordingly, the applicant has amended the claims to more clearly differentiate the present invention from the technologies disclosed by the cited Nishimura et al. reference.

More specifically, the applicant has clarified the location of the first portion and the second portion of the cutting edge by adding the feature "both the first portion and the second portion being located at a radially inner portion of the ball-nosed end cutting edge as seen in a distal end view" to Claims 3 and 9. This feature is clearly supported by the original disclosure of the instant application, for example, at paragraphs [0033] and [0034] with reference to Fig. 2(a).

In the ball endmill of the present invention defined in Claims 3 and 9, each of the ball-nosed end cutting edges includes the first and second portions located at the radially inner portion of the ball-nosed end cutting edge as seen in the distal end view. The first and second portions have the respective first and second radii of curvature which are different in the value from one another in the distal end view seen in the direction of axis. This unique construction causes a cutting resistance (cutting torque)

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exerted by a workpiece, to act in the directions that are different in the first and second portions of each ball-nosed end cutting edge. As a consequence, vibrations are canceled with one another, thereby making it possible to restrain the vibration. The cited Nishimura reference does not show this unique structure and effects of the present invention as discussed below.

The cited Nishimura et al. reference (JP 55-42760) discloses a milling tool with a shank and a cutting part, the cutting part having cutting grooves running helically along its periphery and extending to the end face of the cutting part and also having, at its end face, cutting edges which are formed where the cutting-grooves intersect the end face of the tool. In the office action, the examiner stated that the cited Nishimura et al. reference shows the first portion extending from said axis and the second portion contiguous to the first portion.

As noted above, the essential features of the present invention defined in Claims 3 and 9 amended herein reside in that (1) each of the ball-nosed end cutting edges includes the first and second portions located at the radially inner portion of the ball-nosed end cutting edge as seen in the distal end view, and (2) the first and second portions have the respective first and second radii of curvature which are different in the value from one another in the distal end view. These essential features (1) and (2) of the present invention are not disclosed or suggested by the cited Nishimura et al. reference as discussed below.

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With respect to the feature (1), in the present invention, both the first and second portions are located at the radially inner portion of the ball-nosed end cutting edge as seen in the distal end view. As shown clearly in Figure 2(a), the first portion 6c1 and the second portion 6c2 are located inside of the outer circle (radially inner portion of the cutting edge in the distal end view). It is apparent that the outer circle illustrated in Figure 2(a) is a locus of the outer rim of the cutting tool as seen in the distal end view when the tool is rotated .

By the feature (1) recited in Claims 3 and 9, the applicant has clarified that the second portion 6c2 is not constituted by the outer circle, i.e., the outer cutting edge of the cited Nishimura et al. reference. As seen from the drawings of the cited Nishimura et al. reference and the figure indicated by the examiner at page 5 of the office action, there is only one cutting edge (first portion) 3' extended from the axis at the inside the outer circle (radially inner portion of the cutting edge in the distal end view). In other words, the milling tool of the cited Nishimura et al. reference does not have the second portion of the present invention. Therefore, the essential feature (1) of the present invention noted above is not shown or suggested by the cited Nishimura et al. reference.

With respect to the feature (2), in the present invention, the first and second portions have the respective first and second radii of curvature which are different in the value from one

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another in the distal end view. As clearly illustrated in the distal end view of Figure 2(a), the first portion 6c1 and the second portion 6c2, both of which are located inside of the outer circle, have different radius of curvature. The curvature of the first portion is sharper than that of the second portion, i.e., the radius of curvature of the first portion 6c1 is smaller than that of the second portion 6c2.

In the cited Nishimura et al. reference, however, there is only one cutting edge 3' within (radially inner portion) the outer circle (outer cutting edge) in the distal end view. Namely, there is no cutting edge in the cited Nishimura et al. reference that corresponds to the second portion 6c2 of the present invention at the radially inner portion of the cutting edge in the distal end view. Therefore, the essential feature (2) of the present invention noted above is not shown or suggested by the cited Nishimura et al. reference.

As discussed above, none of the cited references show the essential features (1) and (2) of the present invention. Thus, the applicant believes that the rejection of Claim 9-10 under 35 U.S.C. 102(b) based on the cited Nishimura et al. reference is no longer applicable to the present invention. Further, the applicant believes that the rejection of Claims 3-8 under 35 U.S.C. 103(a) based on the cited Nishimura et al. reference is no longer applicable to the present invention either.

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In this opportunity, the applicant has amended the abstract to be consistent with the amendment in the claims. This is to verify that no new matter has been introduced by this amendment.

In view of the foregoing, the applicant believes that the instant application is in condition for allowance, and accordingly, the applicant respectfully requests that the present application be allowed and passed to issue.

Respectfully submitted,

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